International Journal of Dental
Research & Development (IJDRD)
ISSN(P): 2250-2386; ISSN(E): 2321-0117
Vol. 4, Issue 2, Apr 2014, 19-26

HYFLEX® CM CHANGING DNA OF ENDODONTIC ROTARY FILES

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ABSTRACT

"Any technology that is sufficiently advanced is indistinguishable from magic". This relates very well to the clinical practice of endodontics which has experienced exquisite innovations with succeeding years. Over the past decade, development of new technology and systems such as nickel titanium rotary instrumentation, microscopic endodontics, digital radiography, ultrasonic irrigation, a plethora of obturation systems, and biocompatible sealing materials have all helped to improve the precision, efficiency and accuracy of endodontic procedures than ever before. This is not implying that endodontic treatment has become easier; however, better tools and technology have made the prognisis of surgical and non-surgical procedures more predictable and has challenged us to take on a wider variety of complex cases. Rotary endodontics is one such arena which has constantly been evaluated on the grounds of accuracy and precision.

KEYWORDS: Endodontics, Rotary Files, Nitinol, Hyflex

INTRODUCTION

Endodontic therapy is often complicated and technically demanding. It is one of the fastest growing disciplines in daily clinical practice whereas contemporary endodontics often involves the introduction of many new instruments, materials and techniques.[1,2]

One of the primary goals of endodontic therapy is the complete debridement of pulp tissue from the canal, coupled with shaping of the root canal system.[3,4] The ability to enlarge a canal without deviation from the original canal curvature is a primary objective in endodontic instrumentation. [5,6]

NiTi is a shape-memory alloy also commonly referred to by the name Nitinol, derived from its place of discovery, the Nickel Titanium Naval Ordinance Laboratory. William Buehler, along with Frederick Wang, discovered its properties during research at the Naval Ordinance Laboratory in 1962.[7]

The discovery of the shape-memory effect dates to 1932, when Swedish researcher Arne Olander first observed the property in gold-cadmium alloys. The material, if deformed while cool, returns to its undeformed shape when warmed.[8]

NITINOL: REVOLUTION

Nitinol is typically composed of approximately 54.5% to 57% nickel by weight. Making small changes in the composition can change the transition temperature of the alloy significantly. For this reason, Nitinol may or may not be superelastic at room temperature. These unique properties and adaptation of Nitinol can be used in a wide range of temperatures, making it suitable for rotary endodontic instruments.

NiTi is extremely flexible; it is five times more flexible than stainless steel and appears to be 10 times more resistant to stress.[9]Nitinol shape-memory alloys undergo a phase transformation in their crystal structure when cooled from

the stronger, high temperature form simple cubic crystal structure (austenite) to the weaker, low temperature form (martensite). This inherent reversible, solid phase transformation known as the martensitic transformation is the force behind shape-memory alloysand superelasticity.[10]

Research investigations have proven that NiTi is biocompatible and anticorrosive and does not weaken following sterilization.[11,12]

An advantage of HyFlex® CM (controlled memory) files is that they can be used with multiple techniques (crown-down, step-back) or with the single-length technique proposed by the manufacturer.

The most recent research results testing the fatigue behavior of conventional NiTi instruments and CM NiTi wire concluded that the material property had a substantial impact on fatigue lifetime, and the rotary files made from CM wire had a significantly higher resistance to fracture with lower surface strain amplitude than the conventional NiTi wire with identical design.

The Following are General Recommendations for the Instrumentation Process

- Sterilize files prior to use.

Sterilization Instructions

- Remove files from the packaging prior to sterilization. Note that due to the unique features of the alloy, the files may be slightly bent as a result of the packaging process. This can be gently corrected by hand.
- Place the devices in a file block, support, or container to avoid any contact between instruments.
- If the disinfecting solution contains a corrosion inhibitor, it is recommended to rinse the instruments just before autoclaving.
- Put the file kit in a sterilizable wrap or container. Steam sterilization at 134°C/273°F for 6 minutes; for prior to activation, 18 minutes is recommended.
- Keep devices in the sterilization packaging stored in a dry, clean environment
- Use of a slow-speed hand-piece is required. Operate the hand-piece at 500 rpm. Recommended torque setting is up to 2.5 N·cm (25 mN·m)
- Irrigate/lubricate the canal frequently when using the files
- Clean file flutes after each and every insertion into each and everyroot canal
- Recapitulate between each step with the patency file

STEP BY STEP PROCEDURE

Hyflex™ CM files can be used with crown down, step-back or with single use technique which provides an innovative approach that combines the advantages of both step back and crown down preparation techniques and also allows easy, safe, predictable enlargement of the apical third.

Sequence

1. Prepare with hand file up to 02/20
2. 08/25: Orifice Opener
3. 04/20: apical enlargement
4. 04/25: apical enlargement
5. 06/20: preparation of root mid section
6. 04/30: apical enlargement or with
7. 04/40: apical enlargement

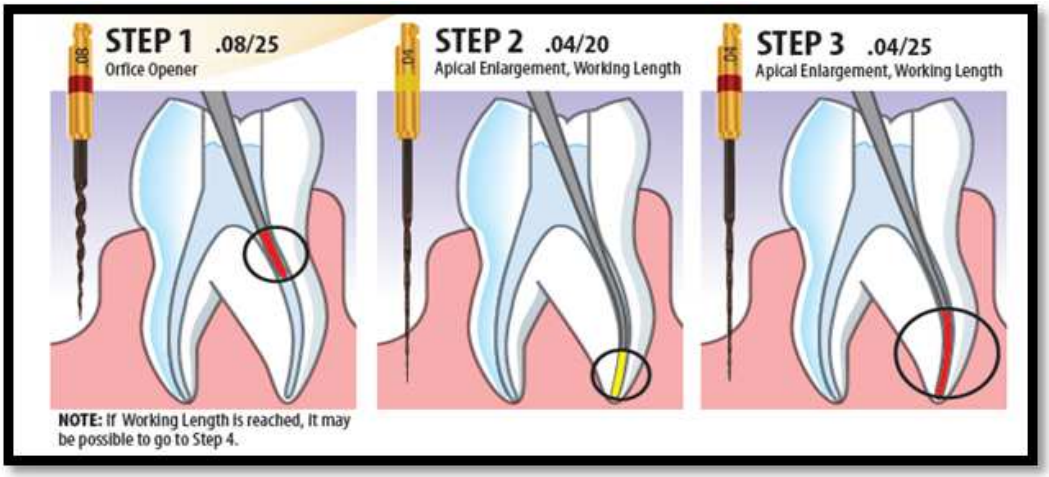

Figure 1

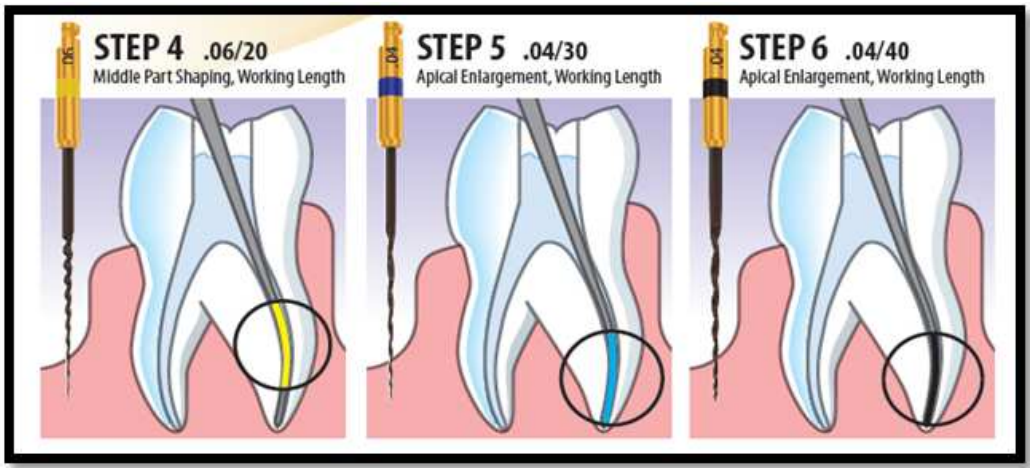

Figure 2

Immediately after use, soak all instruments in a detergent and disinfecting solution combined with a proteolytic enzyme, if possible. If debris is left on the file, use a soft toothbrush for cleaning.

CLINICAL CASES

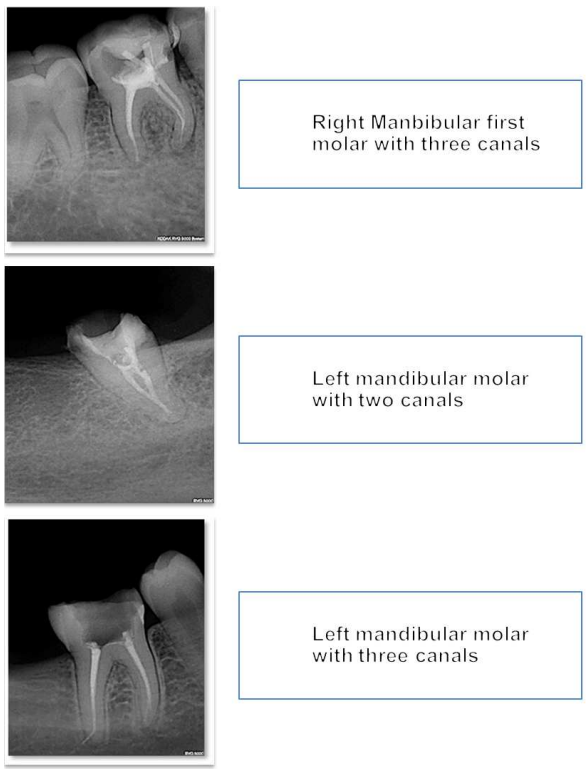

Figure 3

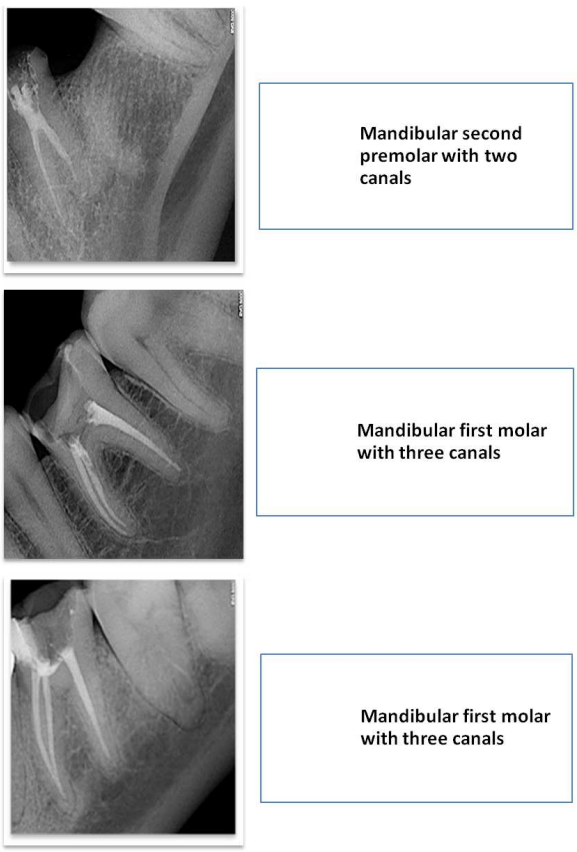

Figure 4

DISCUSSIONS

Endodontic outcomes are improved when the instruments pass through the access opening, effortlessly slide down smooth axial walls and are easily inserted into the orifice. The potential to consistently shape canals and clean root canal systems is significantly enhanced when the coronal two-thirds of the canal is first pre-enlarged followed by preparing its apical one third.[13]

After obtaining a straight-line access, pulp chamber is filled with a viscous chelator-EDTA. Then ISO 02/10 and 02/15 hand files are utilized within the canal until they are loose and a smooth reproducible glide path.Prior to initializing the shaping procedure, the working length is confirmed with root zx II apex locator. Pulp chamber is filled with a solution of NaOCl. The secured portion of the canal can be optimally pre-enlarged by utilizing first hyflex file 08/25 as an orifice opener in light pecking motion without any pressure. 08/25 is the only file with neutral rake angle rest all the files have positive rake angle.This working length is thentransferred to the further Hyflex shaping files.

Subsequently 04/20 and 04/25 hyflex files are introduced into the canal gently with light pecking motion without any pressure. To optimize the safety and efficiency, the shaping files are used to follow glide path passively along the lateral surfaces of the canal to selectively cut the dentin on the outstroke. In case of resistance encountered in using successive files previous step is repeated. A hand file 02/15 is used after each step to check for anatomical inspection to working length and maintain the patency.

06/20 hyflex file is introduced up till the junction of middle and apical one third in well lubricated and irrigated canals. The intend to use 06/ taper is to precisely enlarge and shape the critical junction between middle and apical third which is the prone for most of the endodontic mishaps such as instrument separation, canal blockage, perforation, transporation etc. Adequate enlargement of this narrowest part of the canal also facilitates copious irrigation to liberate the debris out of the canal.

Conclusively, the apical portion of the canal is shaped with either 04/30 hyflex file or with 04/40 hyflex file. Utmost care should be taken to maintain minor diameter through out the procedure.

Adequate lubrication of canals with EDTA, gauging-tuning and scouting recapitulation with copious irrigation with warm NaOClis key to success.

A distinctive feature of these files are:

- Accelerated flute design and increasingly wider flutes, provides efficient debris transportation
- Absence of radial lands, variable pitch and constant helical angles helps in minimizing the torque.
- Its unique design of neutral rake angle helps in planning the canals without exuberant cutting.

The danger of breakage can also be minimized by visual inspection of the flutes. Files, which are recoiled, need to be discarded. If a glass bead sterilizer is available the files can be regenerated during treatment, while the autoclaving actually strengthens the file for multiple use.

LIMITATIONS

With the advent of cone beam computed tomography (CBCT) and the wide adoption of the surgical operating microscope, some of the problems of larger NiTi tapered rotary instruments have been detected, such as the lack of flexibility and adaptation to the canal space anatomy not detected in two-dimensional radiographs.

Larger NiTi instruments may transport the canal space, causing strip perforations because of their rigidity. It is clear that prolonged reuse of NiTi rotary instruments strongly affects instrument fatigue, and recent data suggest the hypothesis that other factors (primarily errors and misuse) may be more accountable for intracanal instrument separation.

Further studies are assessing the cyclic fatigue of each instrument at different levels of the shaft by altering the radius of curvature.[14]

RECOMENDATIONS FOR PREVENTING BREAKAGE OF NICKEL TITANIUM ROTARY FILES

- Open the coronal aspect of canal with hand files prior to obtaining a working length. Remove coronal constrictions and decrease overall canal curvature. Use a modified slow-speed handpiece with these files. Some clinicians prefer an electric handpiece with a constant torque: others prefer a reduced-speed air-driven handpiece. It is critical that the files be rotated no faster than 500 revolutions per minute.
- Use files passively. Use no more pressure than that which would break a sharp lead pencil. Let the file do the work, and advance slowly, backing out when resistance is encountered.
- Discard files regularly. These files can break before any unwinding of the flutes is evident. The only predictable way to prevent failure is to discard regularly after a certain number of uses.
- Discard if any unwinding of the file is noted and file does not regenerate after autoclaving.
- Use a lubricant such as RC-Prep (Premier).

CONCLUSIONS

The explosive development of new technology in endodontic therapy, as well as groundbreaking solutions to previously unanswered questions, will continue at an exponential rate well into this millennium. Similarly innovation in file design is sure to continue, and there will probably never be a consensus choice of brand and taper.

Understanding the concept of machining canals, and preventing breakage by opening the orifices first and using a light touch, will afford us the benefit of these files in every design. It is our responsibility to stay abreast of the continuing advances, and remember Steve Buchanan's admonition: "Buying a Skilsaw does not make you a carpenter.

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